Technical Memorandum

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From: Bruce Langhus, ALL Consulting

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Date: August 25, 2006

Re: Summary of Potential Environmental Impacts Due to CBNG Water Treatment Activities in the Powder River Basin of Montana

Introduction

ALL Consulting (ALL) has prepared this technical memorandum for the Montana Department of Environmental Quality (MDEQ) as a summary of those impacts to the environment that could potentially be brought about by facilities that treat Coal Bed Natural Gas (CBNG) water in the Montana portion of the Powder River Basin (PRB). In particular this memo deals with those potential impacts not considered in the ***Final Statewide Oil and Gas Environmental Impact Statement and Proposed Amendment of the Powder River and Billings Resource Management Plans*** published in 2003 by the United States Department of the Interior and the State of Montana. This FEIS addressed potential impacts to surface and groundwater resources from water treatment facilities likely to be installed in Montana. Because these impacts were thoroughly dealt with in the FEIS, the following memo does not consider potential impacts to surface water or groundwater.

Summary of Potential Impacts and Assumptions

At the present time, only one facility operates in the Montana portion of the PRB to treat CBNG water. There are a dozen or more on the Wyoming side of the basin and others that could be installed in the near future. Across the PRB, treatment and discharge of CBNG water is a popular option in the operator's toolbox of water management technologies. Other popular options include untreated discharge, irrigation, evaporation ponds, and livestock watering. Changing regulations may force operators to use treatment as their only option for discharging CBNG water. If that happens, either operators will choose other water management options or the number of water treatment facilities in the PRB may need to be increased. Instead of 15 Wyoming facilities, 200 or more may be needed to manage the CBNG water produced and discharged in that part of the basin. Instead of a single water treatment facility in the Montana portion of the PRB, as many as 175 or more may be required to treat the entire volume of water predicted by the Supplemental EIS. This memo collects those aspects of the existing water treatment technologies that have the potential for affecting the environment of the PRB. These aspects include the following:

- Disturbed acreage
- Daily treated volume
- Beneficial uses of treated water
- Daily waste brine volume
- Waste brine transport
- Waste brine disposal
- Other waste products
- Potential for accidental releases
- Total heavy truck traffic
- Air quality impacts
- Visual impacts
- Noise impacts

- Onsite staffing levels
- Electric power consumption

We have included design parameters and expected performance data for those technologies that have not been installed in the PRB or that have not been operating long enough to have a reliable performance standard. These parameters are identified as being tentative. This memo tries to include those technologies that appear to be applicable to treating CBNG water; their inclusion in this memo in no way constitutes an endorsement of the technology by the MDEQ, by ALL, or anyone associated with the project.

Water Treatment Technologies

Applicable water treatment options are limited to those that have been implemented or tested on CBNG produced water similar to water in the PRB. Only the following technologies are considered:

- Ion exchange
- Reverse osmosis
- Freeze-thaw

These processes have long track records and have shown themselves to be economically viable under appropriate conditions. Each of these processes accepts water similar to PRB CBNG produced water and each process discharges two water streams – treated water that is of very high quality that can be used for livestock or irrigation and waste brine that usually lacks any beneficial use and must be disposed of. Beyond these similarities, the technologies are somewhat different and even processes within each technology can be very different. Some facilities receive water from coal seams that produce poorer quality water while other facilities are located so as to receive only higher quality water that does not need as much treatment. The volume of waste brine is related to the volume of throughput, the raw water quality, and the desired water quality of the output. Facilities that are designed to output very high quality water and use low quality raw water will have less efficiency and higher volumes of waste brine. Facilities that do not need to achieve high quality thresholds and use fresher CBNG water will be more efficient and generate smaller volumes of waste brine. A single facility using a single kind of raw water will be more efficient with a lower quality threshold than with a higher quality threshold; this needs to be considered when interpreting the potential impacts described below if the discharge thresholds were to be changed.

Potential environmental impact issues

Each commercial treatment process is discussed in terms of the fourteen possible impacts listed above.

Ion Exchange – EMIT System

The EMIT commercial ion exchange treatment system is the most used in the PRB where 15 facilities are processing CBNG water. Produced CBNG water of varying quality can be treated within the EMIT system although the process varies slightly between locations. Frequently only part of the produced water stream is treated and then the treated water is mixed with raw water with the resulting mixture meeting the quality criteria for the beneficial use. EMIT operates one site in the Montana portion of the PRB as well as 14 facilities at 12 sites in the Wyoming portion. Some of these facilities have over two years of operating history.

Disturbed surface acreage: This figure will vary but the average is between 2 and 3 acres per facility including the building, tank battery, and storage pond. If space were at a premium, the facility could be more compact.

Daily treated water volume: Between 8,000 and 28,000 barrels per day (bpd) are the current design volumes although larger facilities are possible. Treated water throughput is approximately 50% of this figure with the discharge being a mixture of treated and raw CBNG water. An average of approximately 4,000 to 14,000 bpd of CBNG water is treated at these facilities.

Beneficial uses of treated water: The mixed treated and raw water discharged from these facilities are most often conveyed to a dry drainage or active stream within the PRB. A small part of the total volume of treated water is used locally for irrigation. A number of other agricultural and industrial uses are possible with this treated water but have not been pursued up to the present time.

Daily waste brine volume: Once each EMIT facility is stabilized, approximately 1% of the treated volume (approx. 40 to 140 bpd per facility) is generated. This waste brine has been found to be a Class I non-hazardous industrial waste. Less efficient setups using higher TDS raw water or those facilities designed to produce a cleaner discharge would generate more waste brine, up to 10% of throughput (400 to 1,400 bpd per facility).

Waste brine transport: While pipelining is certainly possible, waste brine is currently hauled away in trucks to an appropriate disposal facility.

Waste brine disposal: Waste brine from the EMIT facilities is transported to one of two Wyoming Commercial Class I (hazardous and non-hazardous industrial wastes) disposal wells. These wells are both currently at capacity, according to Don Likwartz at WOGCC. Additional disposal facilities are not yet available. No Class I disposal wells exist in Montana. If more water treatment facilities are installed in the Montana portion of the PRB, other disposal options will need to be found.

Other waste products: Sludge from the neutralizing tank needs to be managed from time to time but this is a negligible volume on a daily basis. Spent resin is only rarely encountered; the resin is designed to last for several years. Both of these waste products can be transported to a municipal or county landfill for disposal.

Potential for accidental releases: Transfer valves are within containment structures and spills are rare and contained. Facilities consume a large volume of HCl acid per day, although the volume of acid used each day is proprietary information. The greatest risk would likely be from traffic mishaps while trucks of acid or waste brine are on the road.

Total heavy truck traffic: Like most ion exchange facilities, the majority of truck traffic is hauling of waste brine. Water trucks are heavy duty tractor-trailer units with up to 120 bbls (approximately 42,000 lbs) capacity. At the present time, between 40 and 140 bbls of brine per day are generated at EMIT facilities. This equates to from five to 15 trucks per week to haul out waste brine. In addition, several truckloads of acid may be needed at each facility.

Air quality impacts: Except for the truck traffic, there are no air sources at these facilities. Pumps and compressors are electrically powered.

Noise impacts: Except for trucks, activity is inside the insulated building at each site. Noise levels outside the building are suited to the rural environment.

Onsite staffing levels: Once these facilities are stabilized, operations are monitored remotely in a central Sheridan office. Maintenance personnel are on site one or two hours each day.

Electric power consumption: Each facility uses approximately 100 horsepower (hp) equivalent of power, 100 kilowatts (kw) for operations.

References: Personal conversations between Dr. Langhus and Doug Beagle (307/673-0883) of EMIT, June 28 and 30, July 31, 2006.

Ion Exchange – Drake Engineering

Drake Engineering of Helena, Montana, has developed a proprietary ion exchange process using different components and different resin than the EMIT. This process is said to focus on the removal of sodium ions. Drake has tested a beta-version of this facility but has recently produced a third generation unit that is awaiting a field trial in the PRB.

Disturbed surface acreage: Unknown at the present time but is expected to be much like the EMIT system of approximately 2 to 3 acres per facility.

Daily treated water volume: This latest generation is designed to treat 250 gallons per minute (gpm) or approximately 8,600 bpd.

Beneficial uses for the treated water: It is expected that the potential for beneficial use is much the same as water produced by EMIT facilities.

Daily waste brine volume: Unknown at the present time but lab tests show that waste brine will be similar to the EMIT process, that is from 1% to 3% of the throughput volume (approximately 86 to 257 bpd). This estimate is rough and the actual, stable waste brine volume could be more than the estimate.

Waste brine disposal: The waste brine from the Drake process is predominantly sodium sulphate, an industrial chemical that does have a market. In order to sell this salt, it would probably need to be concentrated and dried.

Other waste products: It is anticipated that no other waste products will be generated by the process.

Potential for accidental releases: Transfer valves are designed to be within containment structures and spills are expected to be rare and contained. The 250 gpm facility is expected to consume approximately 10 bpd of sulphuric acid. A full size 25,000 bpd plant would be expected to consume approximately 30 bpd of acid. The greatest risk would be from traffic mishaps while trucks delivering acid or removing waste brine are on the road.

Total heavy truck traffic: Depending upon the design capacity and subsequent efficiency of the facility, there may be from five to 15 trucks hauling out waste brine and two trucks delivering acid per week. If a buyer can be arranged for the sodium sulphate, the brine would be concentrated and dried, reducing trucking requirements considerably.

Electrical power consumption: Power requirements are unknown for this facility but are probably approximately the same as EMIT facilities.

Reference: Personal conversations between Dr. Langhus and Vivian Drake, July 6 and 7, 2006.

Proprietary process – NEWS

The NEWS process was developed and marketed by Newpark Industries. The process includes an initial sono-chemical oxidation step that leads to an RO step that removes additional ions. While no facilities are installed in Montana, two facilities are operating in Wyoming - one in the PRB and the other near Pinedale. Both facilities are designed to operate with low quality raw water, in the former case with water produced from the Pinedale and Jonah fields and with the latter taking water produced from the Big George coal seam of the Wyoming PRB. If a NEWS facility were to be installed in the Montana PRB, the process might be more efficient because the CBNG raw water is better quality than the Wyoming raw waters.

Disturbed surface acreage: Less than 2 acres is involved with the PRB facility as a field impoundment is being used by the facility for emergency storage. The installation involves a large central building and small outdoor tanks.

Daily treatment volume: The new facility south of Gillette, Wyoming, was designed to treat 25,000 bpd but is currently being calibrated and is only treating approximately 15,000 bpd.

Beneficial uses of the treated water: All of the water from the Gillette facility is being discharged to a dry tributary of the Powder River.

Daily volume of waste brine: During the trial period, approximately 25 to 30% of the treated volume is waste. Once stabilized, the system is designed to have 10% as waste.

Waste brine transport: The waste brine can be trucked to a landfill or buried onsite in a lined cell.

Waste brine disposal: A crystallizer is utilized to concentrate the waste stream and eliminate the need for a liquid discharge. The crystallizer concentrates the reject water stream by extracting water and recirculating it through the treatment process. Total volume of the reject water is reduced while the associated TDS increases significantly. The concentrated sludge results when water is evaporated and the dissolved solids remain behind. Handling and disposal of the waste sludge is easier, but the disposal of solid waste must avoid contamination of surface soils, surface water, or groundwater by disposing of it in a lined cell.

Other waste products: No other waste stream occurs at this site.

Potential for accidental releases: Lime, acid, and resin are delivered to the facility and salts must be managed. Spills and accidental releases could occur at the facility or on the road.

Total heavy truck traffic: As long as sludge waste is buried onsite, truck traffic is minimal at approximately one per week to supply acid and lime.

Air quality impacts: Except for the truck traffic, there are no air sources at these facilities. Pumps and compressors are electrically powered.

Noise impacts: Except for trucks, activity is inside the insulated building at each site.

Onsite staffing levels: During the set-up phase, the facility is staffed 24 hours per day. Once the facility is stabilized, only minimal staffing should be required.

Electric power consumption: The facility is designed to use up to 600 kw but is currently using much less to power lights, cooling, heating, pumps, and compressors.

References: Personal conversations between Dr. Langhus and Ron Linz of Newpark, July 6 and 25, 2006.

Reverse Osmosis – U.S. Filter

The U.S. Filter subsidiary of Siemens has recently installed a treatment facility south of Gillette, Wyoming, that takes water from CBNG wells operated by PetroCanada. This facility has been operating only a short time and has not stabilized as yet, however, it is similar to many others built and operated around the world by U.S. Filter.

Disturbed surface acreage: Less than 5 acres is involved with the PRB facility. The installation involves a large central building, several outdoor tanks, evaporation ponds, overflow raw water pond, and a treated water pond.

Daily treatment volume: This new facility south of Gillette, Wyoming, is designed to treat 125,000 bpd but is currently being calibrated and is operating well below that figure. After stabilization is achieved, the plant will treat approximately 60,000 bpd and blend with an equal volume of raw water prior to discharge.

Beneficial uses of the treated water: All of the blended water is being discharged to a dry tributary of the Powder River.

Daily volume of waste brine: The facility is designed to average approximately 2 - 3% (50,000 to 75,000 gpd) waste, but is currently at an actual 3-4% (75,000 to 100,000 gpd). Fine tuning the process is expected to reduce the reject to the design parameters. Waste brine will average 1200 to 2400 bpd at the operating level of 60,000 bpd of treated raw CBNG water.

Waste brine transport: The waste brine is trucked offsite.

Waste brine disposal: The waste brine is trucked to a commercial disposal facility or piped to a large evaporation pond for concentration and subsequent disposal. Brine volume is expected to stabilize at approximately 2,000 bpd, although this may change. Large scale use of evaporation ponds could reduce this volume considerably.

Other waste products: No other waste stream occurs at this site.

Potential for accidental releases: Chemicals, acid, and resin are delivered to the facility and brine must be managed. Spills and accidental releases could occur at the facility or on the road.

Total heavy truck traffic: As long as waste brine is trucked directly off the facility without evaporation, truck traffic is expected to be approximately 12 to 24 truck loads per day or 86 to 170 per week.

Air quality impacts: Except for the truck traffic, there are no air sources at these facilities. Pumps and compressors are electrically powered.

Noise impacts: Except for trucks, activity is inside the insulated building at each site.

Onsite staffing levels: Only minimal maintenance staffing is required each day.

Electric power consumption: Exact figure is unknown but the facility only uses power for lights, cooling, heating, pumps, and compressors.

References: Personal conversations between Dr. Langhus and Les Bell of Siemens Filter, July 7, 2006.

Reverse Osmosis – Aqua-Envirotech

Aqua-Envirotech built a facility that underwent a one-year field trial north of Sheridan, Wyoming. The plant processed CBNG water for J.M. Huber Corporation.

Disturbed surface acreage: Less than 2 acres was involved with the PRB facility. The installation involved a small central building, a treated water pond where water was treated to pH and then discharged, and an evaporation pond for the waste brine.

Daily treatment volume: The plant was designed to treat 250 gpm (8,600 bpd) but seldom operated at that level.

Beneficial uses of the treated water: All of the blended water was discharged to Prairie Dog Creek, a tributary of Tongue River.

Daily volume of waste brine: The facility was designed to be approximately 95% efficient with a 5% waste brine, but the plant averaged between 20% and 40% waste brine during the field trial.

Waste brine transport: The waste brine was trucked offsite.

Waste brine disposal: The waste brine was trucked to a commercial disposal site after evaporation.

Other waste products: No other waste stream occurred at this site.

Potential for accidental releases: Acid was periodically delivered to the facility and the brine waste was removed. Spills and accidental releases could occur at the facility or on the road.

Total heavy truck traffic: The brine waste was trucked off the facility after evaporation and acid delivered. Truck traffic may have averaged two or three per week.

Air quality impacts: Except for the truck traffic, there are no air sources at these facilities. Small pumps and compressors were electrically powered.

Noise impacts: Except for trucks, activity was inside the insulated building at the site.

Onsite staffing levels: Only minimal maintenance staffing is required each day.

Electric power consumption: Exact figure is unknown but the facility only uses little power for lights, cooling, heating, and small pumps.

References: Personal conversations between Dr. Langhus and Bill DeLapp of Huber on July 7, 2006.

Reverse Osmosis – High Efficiency RO (HERO)

This technology has been field tested in the San Juan Basin of Colorado and has been lab tested on CBNG water from the PRB. The technology was licensed by Hydrometrics Inc.

Disturbed surface acreage: Unknown.

Daily treatment volume: The plant was designed to treat 250 gpm (8,600 bpd) but seldom operated at that level.

Beneficial uses of the treated water: Treated water could be surface discharged, used for local irrigation, or other beneficial uses.

Daily volume of waste brine: Approximately 11% of the input stream is rejected, although several tests utilizing PRB raw waters varied from 4% to 17% reject depending upon the concentration of the feedstock. It can be estimated that between 350 and 1500 bpd of waste could be expected from a PRB facility treating 250 gpm.

Waste brine transport: The waste brine may be trucked offsite.

Waste brine disposal: The waste brine might be trucked to a commercial disposal site.

Other waste products: No other waste stream is expected to occur at this site.

Potential for accidental releases: Acid must be periodically delivered to the facility and the brine waste was removed. Spills and accidental releases of this material could occur at the facility or on the road.

Total heavy truck traffic: Truck traffic may average three to 15 trucks per day, or up to 105 trucks per week.

Air quality impacts: Except for the truck traffic, there would be no air sources at this facility. Small pumps and compressors would be electrically powered.

Noise impacts: Except for trucks, activity would be inside an insulated building at the site.

Onsite staffing levels: Only minimal maintenance staffing would be required each day.

Electric power consumption: Exact figure is unknown but the facility would use little power.

References: Personal conversations between Dr. Langhus and Bob Bradley, licensee of HERO on July 7, 2006.

Freeze-Thaw Evaporation (FTE)

This technology is currently being used in the Red Desert of Wyoming by Samson to treat 1000 bpd (annual average) of produced water. The system utilizes the natural seasons of the Red Desert to 1) evaporate water through spray evaporation in both summer and winter months, and 2) in winter months the spray that does not evaporate freezes to a freeze pad. Due to the freezing point of water with high TDS being lower than pure water, the water that does not freeze in the winter months is separated from the water that does freeze. The concentrated brine is diverted to a holding pond and the water that is frozen is able to be put to beneficial use (stock watering, land application, etc) as it thaws in the summer months.

The technique is efficient in its use of power and its generation of waste brine but it does require a great deal of space to be able to process a volume of water similar to the other technologies.

Disturbed surface acreage: The existing facility that manages 1000 bpd requires 10 individual one-acre pits. Each pit is lined and is 13 feet deep, with 3.0 feet of freeboard when the pit is at full capacity (ie a total of 100 acre-ft of storage). Access roads may increase this figure to 12 ac per site. In order to compare to the water management capability of a large ion exchange or RO facility, an FTE site capable to managing 20,000 bpd would require approximately 240 ac.

Daily treatment volume: The Red Desert facility was designed to treat 1,000 bpd but could be scaled up to a much larger size.

Beneficial uses of the treated water: Treated water can be surface discharged, used for local irrigation, or livestock watering.

Daily volume of waste brine: During the freeze-thaw cycle, approximately 15% of the water is waste brine, but salts are further concentrated within the evaporation ponds where it is stored until disposal. Evaporation concentrates the brine to a very high degree and it is estimated that less than 1% of the volume remains in the evaporation pond. The operator has not had the need to empty the evaporation pond; therefore no brine has left the facility. Nearby petroleum producers can use the heavy, concentrated brine to periodically treat and stimulate conventional oil and gas wells.

Waste brine transport: The waste brine must be trucked offsite for use or disposal.

Waste brine disposal: The waste brine can be used as an industrial product, taken to a disposal well, or properly buried after further drying.

Other waste products: No other waste stream occurs at this site.

Potential for accidental releases: The brine waste must be removed by truck and spills can occur at the facility or on the road.

Total heavy truck traffic: Truck traffic may average less than one truckload per week of unconcentrated brine from a 1,000 bpd facility. A sized-up unit to handle 20,000 bpd would likely generate 20 truckloads every week.

Current operations, however, evaporate and concentrate the brine and no brine has been trucked off the premises.

Air quality impacts: There are no air sources at this facility. Small pumps are electrically powered.

Noise impacts: None

Onsite staffing levels: Only minimal maintenance staff is required.

Electric power consumption: The only use is for a 7-horsepower electric motor running the main pump.

References: Personal conversations between Dr. Langhus and John Boysen with B.C. Technologies on July 24 and August 4, 2006.

Summary

The table below illustrates the predicted number of drilling applications (APDs) and wells per watershed in the Montana portion of the PRB. This table is taken from the Supplemental EIS as being prepared by the BLM. The development scenario is referred to in the SEIS as the high-range phased development scenario (Alternative F). CBNG development is not expected to be at the greatest possible rate nor is it extrapolated from the relatively restrained rate shown in the past seven years in the Montana portion of the PRB. The SEIS estimates development on Federal minerals to be constrained by a yearly limit per watershed; state and private mineral development is not limited but is estimated to proceed in a roughly south-to-north direction. This understanding of the development on the two mineral estates led to the development scenario expressed in the table. In order to estimate the number of treatment facilities required, we have assumed that 100% of the produced water will be discharged. The estimated number of treatment facilities was derived from the average daily water production assumed by the SEIS and the estimated volume per treatment facility (20,000 bpd).

Operators in several of the watersheds may be able to pipe water from their producing wells to a single treatment plant while other operators may need to construct more facilities because of geographical barriers to pipelines. Waste brine volume as shown in the table is estimated from an assumed average reject rate of 5%, although the actual range is between 30% and 1%. Estimated total surface disturbance from the installation of treatment plants is expected to be very small.

Predicted CBNG Facilities/Watershed Under Alternative F						
HIGH RANGE Phased CBNG Development						
	Watershed Name	**Total CBNG Wells**	**Total APDs**	**Estimated Treatment Facilities**	**Estimated Waste Brine (Truckloads per day)**	**Total Disturbed Acres (2 ac per facility)**
1	Clarks Fork Yellowstone	405	450	**4.3**	**45**	**9**
2	Little Bighorn	608	675	**6.5**	**68**	**13**
3	Little Powder	180	200	**1.9**	**20**	**4**
4	Lower Bighorn	720	800	**7.7**	**80**	**15**
5	Lower Tongue	3105	3,450	**33.0**	**346**	**66**
6	Lower Yellowstone-Sunday	1530	1,700	**16.3**	**171**	**33**
7	Middle Musselshell	90	100	**1.0**	**10**	**2**
8	Middle Powder	1890	2,100	**20.1**	**211**	**40**
9	Mizpah	113	125	**1.2**	**13**	**2**
10	Rosebud	3240	3,600	**34.4**	**361**	**69**
11	Stillwater	90	100	**1.0**	**10**	**2**
12	Upper Musselshell	68	75	**0.7**	**8**	**1**
13	Upper Tongue	3465	3,850	**36.8**	**386**	**74**
14	Upper Yellowstone-Lake Basin	720	800	**7.7**	**80**	**15**
15	Upper Yellowstone-Pompeys Pillar	180	200	**1.9**	**20**	**4**
	Total Predicted	16403	18,225	**174.4**	**1828**	**349**
Predicted treatment facilities is equal to number of wells times 6.5 gpm times 34.29 bpd per gpm, divided by 20,000 bpd per facility.						

The single exceptional potential impact is the heavy truck traffic, particularly to haul off waste brine. If 175 treatment plants are built and if the typical plant produces between 2 and 20 truckloads of brine per day, this is a potential total of up to 2,000 truck trips every day in the Montana portion of the basin. That much traffic would very likely produce impacts to air quality, noise levels, county road deterioration, traffic safety, and especially to the sense of place for residents and visitors. In addition, new more stringent water discharge standards would increase the waste brine volume at each facility by an unknown factor. The environmental impacts of 400 or 500 heavy trucks each traveling four or five roundtrips on the gravel roads of Big Horn, Powder River, and Rosebud counties would be considerable. The dust, the noise, the diesel exhaust, the extra traffic day and night, importation of noxious weeds, impacts to wildlife survival and migration, impacts to soils, and the added wear and tear on county roads may be sufficient to adversely affect day-to-day life in this part of the state.

Commercial waste brine disposal represents a problem at this time because the only commercial disposal wells are located in Wyoming and are at capacity. High volume disposal wells can accommodate 20,000 bpd or about 200 truckloads per day. If 2,000 truckloads of waste brine are generated each day in the Montana portion of the basin, approximately ten commercial disposal wells may be required. Brine volume might be reduced through the use of evaporators, either shallow open ponds or rapid evaporators. The local effects of this many powered evaporators is quite unknown in terms of air quality, noise, and electrical power consumption. The Drake process may represent a welcome change to this waste scenario; the waste brine is reported to be sodium sulfate, a useable commodity that would not require disposal.

Other potential impacts discussed above appear to be minimal, even if a large number of treatment facilities would be needed in the Montana portion of the PRB. For example, if 175 facilities are installed and operated in Montana during the next five years, fewer than 300 site operators might be employed. This is likely not a large economic effect on the population in the area bounded by Hardin, Broadus, Gillette, and Sheridan. Many local ranchers, however, may be able to supplement their incomes by driving water trucks. Visual, noise, and air quality impacts of the facilities themselves can be expected to be relatively minor even if 100 treatment facilities would be built. At the present time, most of the treated water is simply discharged to dry or active drainages, but in the future it is likely that more of the treated water will be used for irrigation purposes, given the very dry conditions in the PRB. Dedicated beneficial use such as irrigation would allow the operators of the treatment facilities to locate them away from the riparian areas of streams, thereby reducing impacts to that vulnerable environment.